AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

LISTING OF CLAIMS

1. (Currently Amended) A control apparatus for controlling a ~~shift~~ torque phase of an up-shifting operation in an automatic transmission having ~~plural shift stages to be established by selecting plural friction engagement elements to be engaged or disengaged~~ a torque converter, an input shaft of the automatic transmission connected to a turbine runner in the torque converter, an output shaft of the automatic transmission, and plural friction engagement elements selectively engaged or disengaged to connect or disconnect the input shaft with the output shaft indirectly for establishing plural shaft stages, wherein when up-shifting from one shift stage of the plural shift stages to another shift stage an off-going friction engagement element of the plural friction engagement elements is switched from an engaged condition to a disengaged condition ~~by~~ for reducing torque transmitted ~~to the off-going friction engagement element at a time of shifting from a shift stage of the plural shift stages another shift stage thereof such that the off-going friction engagement element slips~~ by decreasing a hydraulic pressure supplied such that the off-going friction element starts to slip, and an on-coming friction engagement element of the plural friction engagement elements is switched from a disengaged condition to an engaged condition ~~by increasing torque to be transmitted to the on-coming friction engagement element at the time of shifting~~ for multiplying transmitted torque by

increasing supplied hydraulic pressure such that the on-going friction element stops slipping, the control apparatus comprising:

a slip amount calculating means for calculating a slip amount based upon a rotational speed of ~~an~~ the input shaft ~~of the automatic transmission~~ and a rotational speed of ~~an~~ the output shaft thereof;

a judging means for judging whether or not the calculated slip amount is greater than a predetermined threshold value by comparison;

a target slip amount calculating means for calculating a target slip amount, the target slip amount varied from the predetermined threshold value to a predetermined target value drawing an ideal trace for restraining a shift shock ~~and maintained at the predetermined target value~~ of the torque phase of the up-shifting operation;

a disengaging side controlling means for ~~performing~~ starting to perform an integral-proportional feedback control so as to substantially match the calculated slip amount with the calculated target slip amount for restraining over rotation of the turbine runner due to the up-shifting operation when the calculated slip amount is judged to be in excess of the predetermined threshold value by the judging means; and

an engaging side controlling means for increasing the torque to be transmitted to the on-coming friction engagement element in association with commencement of the integral-proportional feedback control.

2. (Currently Amended) A control apparatus for controlling a ~~shift~~ torque phase of an up-shifting operation in an automatic transmission having ~~plural shift stages to be established by selecting plural friction engagement elements to be~~

~~engaged or disengaged~~ plural friction engagement elements selectively engaged or disengaged to connect or disconnect an input shaft of the automatic transmission with an output shaft of the automatic transmission indirectly for establishing plural shift stages along with control of an oil pressure to be supplied thereto, wherein an off-going friction engagement element of the plural friction engagement elements is switched from an engaged condition to a disengaged condition by reducing torque transmitted to the off-going friction engagement element in response to reduction of the oil pressure supplied to the off-going friction engagement element ~~at a time of shifting~~ when up-shifting from a shift stage of the plural shift stages to another shift stage thereof such that the off-going friction engagement element slips, and an on-coming friction engagement element of the plural friction engagement elements is switched from a disengaged condition to an engaged condition by increasing torque to be transmitted to the on-coming friction engagement element in response to increase of the oil pressure to be supplied to the on-coming friction engagement element at the time of shifting, the control apparatus comprising:

a slip amount calculating means for calculating a slip amount based upon a rotational speed of ~~an~~ the input shaft ~~of the automatic transmission~~ and a rotational speed of an output shaft thereof;

a judging means for judging whether or not the calculated slip amount is greater than a predetermined threshold value by comparison;

a target slip amount calculating means for calculating a target slip amount, the target slip amount varied from the predetermined threshold value to a predetermined target value drawing an ideal trace for restraining a shift shock ~~and maintained at the predetermined target value~~ of the torque phase of the up-shifting operation;

a disengaging side controlling means for starting to perform ~~performing~~ an integral-proportional feedback control so as to substantially match the calculated slip amount with the calculated target slip amount for preventing an over rotation of the input shaft due to the up-shifting operation when the calculated slip amount is judged to be in excess of the predetermined threshold value by the judging means; and

an engaging side controlling means for increasing the torque to be transmitted to the on-coming friction engagement element in association with commencement of the integral-proportional feedback control.

3. (Currently Amended) A control apparatus for controlling a torque phase of an up-shifting ~~a shift~~ operation in an automatic transmission according to claim 2, wherein the engaging side controlling means increases the oil pressure supplied to the on-coming friction engagement element to a level of a stand-by pressure which does not generate the torque at the time of shifting, maintains the oil pressure being supplied to the on-coming friction engagement element at the stand-by pressure level until commencement of the integral-proportional feedback control, and increases the oil pressure being supplied to the on-coming friction engagement element to a level of an oil pressure required for shifting to an inertia phase after the commencement of the integral-proportional feedback control.

4. (Currently Amended) A control apparatus for controlling a torque phase of an up-shifting ~~a shift~~ operation in an automatic transmission according to claim 1, wherein the slip amount to be compared with the predetermined threshold value by the judging means corresponds to a slip amount applied with a first filtering

process for eliminating a first predetermined frequency component from the slip amount, and the slip amount controlled to be substantially matched with the target slip amount by the disengaging side controlling means corresponds to a slip amount calculated based upon the input shaft rotational speed and the output shaft rotational speed applied with a third filtering process for eliminating a third predetermined frequency component from the output shaft rotational speed.

5. (Currently Amended) A control apparatus for controlling a torque phase of an up-shifting ~~a shift~~ operation in an automatic transmission according to claim 2, wherein the slip amount to be compared with the predetermined threshold value by the judging means corresponds to a slip amount applied with a first filtering process for eliminating a first predetermined frequency component from the slip amount, and the slip amount controlled to be substantially matched with the target slip amount by the disengaging side controlling means corresponds to a slip amount calculated based upon the input shaft rotational speed and the output shaft rotational speed applied with a third filtering process for eliminating a third predetermined frequency component from the output shaft rotational speed.

6. (Currently Amended) A control apparatus for controlling a torque phase of an up-shifting ~~a shift~~ operation in an automatic transmission according to claim 4, wherein the slip amount controlled to be substantially matched with the target slip amount by the disengaging side controlling means corresponds to a slip amount calculated based upon the input shaft rotational speed applied with a second filtering

process for eliminating a second predetermined frequency component from the input shaft rotational speed.

7. (Currently Amended) A control apparatus for controlling a torque phase of an up-shifting ~~a shift~~ operation in an automatic transmission according to claim 5, wherein the slip amount controlled to be substantially matched with the target slip amount by the disengaging side controlling means corresponds to a slip amount calculated based upon the input shaft rotational speed applied with a second filtering process for eliminating a second predetermined frequency component from the input shaft rotational speed.

8. (Currently Amended) A control apparatus for controlling a torque phase of an up-shifting ~~a shift~~ operation in an automatic transmission according to claim 1 further comprising:

a lock-up clutch capable of connecting the input shaft of the automatic transmission and the output shaft thereof, wherein the disengaging side controlling means sets a control gain for the integral-proportional feedback control at different values depending on an engaged / disengaged condition of the lock-up clutch.

9. (Currently Amended) A control apparatus for controlling a torque phase of an up-shifting ~~a shift~~ operation in an automatic transmission according to claim 2 further comprising:

a lock-up clutch capable of connecting the input shaft of the automatic transmission and the output shaft thereof, wherein the disengaging side controlling

means sets a control gain for the integral-proportional feedback control at different values depending on an engaged / disengaged condition of the lock-up clutch.

10. (Currently Amended) A control apparatus for controlling a torque phase of an up-shifting ~~a shift~~ operation in an automatic transmission according to claim 1 further comprising,

a reference model included in the target slip amount calculating means and capable of outputting the target slip amount when the reference model is inputted with a value variable in a stair step manner from the predetermined threshold value to the predetermined target value, and

an error feedback controlling means for feedbacking an error between the slip amount calculated by the slip amount calculating means and the target slip amount outputted from the reference model.

11. (Currently Amended) A control apparatus for controlling a torque phase of an up-shifting ~~a shift~~ operation in an automatic transmission according to claim 2 further comprising,

a reference model included in the target slip amount calculating means and capable of outputting the target slip amount when the reference model is inputted with a value variable in a stair step manner from the predetermined threshold value to the predetermined target value, and

an error feedback controlling means for feedbacking an error between the slip amount calculated by the slip amount calculating means and the target slip amount outputted from the reference model.

12. (Canceled)

13. (New) A control apparatus for controlling a torque phase of up-shifting operation in an automatic transmission according to claim 1, wherein the target slip amount increases from the predetermined threshold value to the predetermined target value in dependence on time elapse.

14. (New) A control apparatus for controlling a torque phase of up-shifting operation in an automatic transmission according to claim 1, wherein the target slip amount increases from the predetermined threshold value to the predetermined target value in dependence on time elapse.